

REMARKS

Claims 1-21 are all the claims pending in the application.

Claims 1, 2, 6, 7 and 11 have been amended for clarity. Support for new claim 21 may be found in the specification as originally filed, for example, at pages 6-7 (see the definitions for "W" and "R₄").

I. The Rejection Based on Kodama et al in view of Kobayashi et al

Claims 1-20 are rejected under 35 U.S.C. §103(a) as allegedly being unpatentable over Kodama et al in view of Kobayashi et al.

Applicants respectfully submit that Kodama et al is not available as a reference and request that the Examiner reconsider and withdraw the rejection based, in part, on Kodama et al in view of the following remarks.

Kodama et al is only available as a reference as of its filing date under 35 U.S.C. §102(e). Under 35 U.S.C. §103(c):

Subject matter developed by another person, which qualifies as prior art only under one or more of subsections (e), (f), and (g) of section 102 of this title, shall not preclude patentability under [§103] where the subject matter and the claimed invention were, at the time the invention was made, owned by the same person or subject to an obligation of assignment to the same person.

Since the present invention and Kodama et al were commonly owned at the time of the making of the present invention, Kodama et al is not available as prior art under §103(c). The instant application is an application to which 35 U.S.C. §103(c) applies.

Fuji Photo Film Co., Ltd. is the assignee of Kodama et al and is also the assignee of the instant Application by virtue of an Assignment, recorded December 27, 2000, at reel 011427, frame 0353, from all of the inventors thereof executed on December 20, 2002

The undersigned hereby represents that Kodama et al and the claimed invention were, at the time the invention of the instant application was made, owned or subject to an obligation of assignment to Fuji Photo Film Co., Ltd.

In view of the above, it is respectfully submitted that Kodama et al is not available as art under 35 U.S.C. §103 and it is requested that the rejection under 35 U.S.C. §103(a) be reconsidered and withdrawn.

II. The Rejections Based on Iwasa et al in view of Kobayashi et al

Claims 1, 3, 4, 8-10, and 12-20 are rejected under 35 U.S.C. §103(a) as allegedly being unpatentable over Iwasa et al in view of Kobayashi et al.

Claims 5 and 11 are rejected under 35 U.S.C. §103(a) as allegedly being unpatentable over Iwasa et al in view of Kobayashi et al further in view of Tan et al.

Applicants respectfully submit that the present invention is not anticipated by or obvious over Iwasa et al in view of Kobayashi et al, alone or further in view of Tan et al, and request that the Examiner reconsider and withdraw this rejection in view of the following remarks.

Filed concurrently herewith is a Declaration under 37 C.F.R. §1.132, which includes comparative data representative of the cited art and which shows unexpectedly superior results obtained by the present invention over the teachings of the cited art. As set forth in further detail in the §132 Declaration, unexpected improvements in pitch density and in exposure latitude are obtained by the use of the claimed resin having an acid-decomposing group represented by formula (I), at least one compound which generates an acid by the irradiation of an active light or radiation and contributes to the decomposition reaction of the above-described acid-decomposing group (b-1), and at least one compound which generates an acid by the irradiation of an active light or radiation but does not contribute to the decomposition reaction of the above-described acid-decomposing group (b-2).

The unexpected improvements are not expected from the teachings of Iwasa and Tan, each of which do not disclose the photo-acid generator (b-2) of the present invention, and Kobayashi, which does not disclose the resin (a) of the present invention.

For the above reasons, it is respectfully submitted that the subject matter of claims 1, 3, 4, 8-10, and 12-20 is neither taught by nor made obvious from the disclosures of Iwasa et al and Kobayashi et al, either alone or in combination with Tan et al, and it is requested that the rejection under 35 U.S.C. §103(a) be reconsidered and withdrawn.

Amendment Under 37 C.F.R. § 1.111
U.S. Appln. No. 09/748,198

III. Conclusion

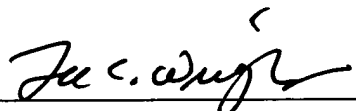
In view of the above, Applicants respectfully submit that their claimed invention is allowable and ask that the rejection under 35 U.S.C. §112 and the rejection under 35 U.S.C. §103 be reconsidered and withdrawn. Applicants respectfully submit that this case is in condition for allowance and allowance is respectfully solicited.

If any points remain at issue which the Examiner feels may be best resolved through a personal or telephone interview, the Examiner is kindly requested to contact the undersigned at the local exchange number listed below.

The USPTO is directed and authorized to charge all required fees, except for the Issue Fee and the Publication Fee, to Deposit Account No. 19-4880. Please also credit any overpayments to said Deposit Account.

Respectfully submitted,

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APPENDIX
VERSION WITH MARKINGS TO SHOW CHANGES MADE

IN THE CLAIMS:

The claims are amended as follows:

1 (amended). A positive-working radiation-sensitive composition comprising

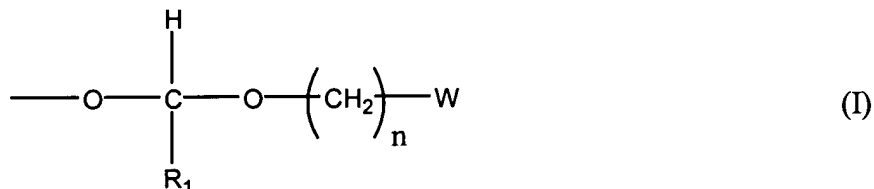
(a) a resin having an acid-decomposing group represented by the following formula (I), which is decomposed by the action of an acid to increase the solubility in an alkali developer,

(b-1) at least one [kind of compounds each] compound which generates an acid by the irradiation of an active light or radiation and contributes to the decomposition reaction of the above-described acid-decomposing group,

(b-2) at least one [kind of compounds each] compound which generates an acid by the irradiation of an active light or radiation but does not contribute to the decomposition reaction of the above-described acid-decomposing group,

(c) a surface active agent, and

(d) a solvent;



wherein, R₁ represents an alkyl group having from 1 to 4 carbon atoms; W represents an organic group containing at least one kind of atom selected from the group consisting of an oxygen atom, a nitrogen atom, a sulfur atom, a phosphorus atom, and a silicon atom, and at least one carbon atom, an amino group, an ammonium group, a mercapto group, a substituted or unsubstituted aryl group, or a substituted or unsubstituted cyclic alkyl group; and n represents an integer of from 1 to 4.

2 (Amended). The positive-working radiation-sensitive composition according to claim 1, wherein [the above-described] said resin (a) comprises repeating units, each containing a hydroxystyrene group, wherein [is a resin in which] at least a part of [a phenolic hydroxy] the hydroxy groups of the hydroxystyrene groups of the repeating units [group of an alkali-soluble resin having the phenolic hydroxy group is] are protected by [the] said acid-decomposing group [shown by the above-described] of formula (I).

6 (Amended). The positive-working radiation-sensitive composition according to claim [1] 2, wherein [a phenolic] from 5 to 45 mol% of the hydroxy [group] groups of the hydroxystyrene groups of the repeating units of the resin (a) [is] are protected by [the] said acid-decomposing group of formula (I) [in a ratio of from 5 to 45 mol%].

7 (Amended). The positive-working radiation-sensitive composition according to claim [1] 2, wherein [a phenolic] from 10 to 30 mol% of the hydroxy [group] groups of the hydroxystyrene groups of the repeating units of the resin (a) [is] are protected by [the] said acid-decomposing group of formula (I) [in a ratio of from 10 to 30 mol%].

11 (Amended). The positive-working radiation-sensitive composition according to claim 1, wherein the composition further contains an alkali-soluble resin [without containing the] which does not contain an acid-decomposing group.

Claim 21 is added as a new claim.

PATENT APPLICATION

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re application of:

Shinichi Kanna et al.

Group Art Unit 1752

Appin. No.: 09/748,198

Examiner: LEE, SIN J

Filed: December 27, 2000

For: POSITIVE-WORKING RADIATION-SENSITIVE COMPOSITION

DECLARATION UNDER 37 C.F.R. §1.132Assistant Commissioner for Patents
Washington, D.C. 20231

Sir:

I, Shinichi Kanna, do declare and state as follows:

I am a citizen of Japan.

I graduated from The University of Tokyo, and received a Master's Degree in the course of Chemistry and Biotechnology in March 1998.

Since April 1998 I have been employed by Fuji Photo Film Co., Ltd. and have been engaged in research and development of photoresist photosensitive materials for semiconductors at the Yoshida-Minami Factory Research Division of the company.

I am a co-inventor of the invention described and claimed in the above-named application, and I am familiar with the subject matter disclosed by the application as well as the Office Action dated February 27, 2002 concerning the application.

In order to demonstrate the unexpected superiority of the present invention, the following experimentation was conducted by me or under my supervision.

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EXPERIMENTATION

Additional Example 1 and Additional Comparative Example 1

Additional Comparative Example 1 was made according to US 5,984,025

(Iwasa).

Table A1

	(a) Resin (g)	(b-1) Photo-acid generator (g)	(b-2) Photo-acid generator (g)	(c) Surface active agent (ppm)
Additional Example 1	Resin [24] (0.99) *	PAG-A (0.005) **	Photo-acid generator (II-1) (0.005) ***	W-1 (100) ****
Additional Comparative Example 1	Resin [24] (0.99) *	PAG-A (0.005) **	None	W-1 (100) ****

*: Resin [24] of Embodiment 7 described in Iwasa, which falls within the scope of the invention

**: PAG-A is N-hydroxysuccinimide-toluene-sulfonate of Embodiment 7 described in Iwasa, which falls within the scope of the invention

***: Photo-acid generator (II-1) of Example 7 described in the present specification

****: W-1 of Example 7 described in the present specification

The components set forth in Table A1 above were dissolved in 4 g of PGMEA (propylene glycol monomethyl ether acetate) as a solvent, and then filtered through a filter having a pore diameter of 0.2 μ m to prepare a resist solution. The resist solution thus prepared was applied to a silicon wafer by means of a spin coater, and then dried over a vacuum adsorption type hot plate at a temperature of 90°C for 60 seconds to obtain a resist film having a thickness of 0.5 μ m.

The resist film was then exposed using a KrF excimer laser stepper (NA = 0.63) of a wavelength of 248 nm. After exposure, the resist film was heated over a 100°C hot plate for 60 seconds, immediately dipped in a 0.048% aqueous

present
triphenyl sulfonium
p-tolyl acetate
(present)
Kobayashi
Teaches
- sulfonium
salt of
carboxylic
acid

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solution of tetramethylammonium hydroxide (TMAH) for 60 seconds, rinsed with water for 30 seconds, and then dried. The pattern on the silicon wafer thus formed was observed under a CD-measurement scanning type electron microscope (CD-SEM). As a result, the resist performance (pitch dependency and exposure latitude) set forth in Table A2 below was obtained.

The evaluation of pitch dependency and exposure latitude was carried out according to the methods described in the present specification.

Table A2

	Iso/Dense difference ΔCD	Exposure latitude Δexp
Additional Example 1	17.8 nm	10.8%
Additional Comparative Example 1

In Additional Comparative Example 1, measurements were not obtained, since the limiting resolution was $0.20 \mu m$ (the minimum dimensional value resolved was $0.20 \mu m$) and the image was not resolved to $0.17 \mu m$ and $0.15 \mu m$, which are dimensions to be evaluated for pitch dependency and exposure latitude, respectively.

Additional Example 2 and Additional Comparative Example 2

Additional Comparative Example 2 was made according to US 6,136,500 (Kobayashi).

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Table B1

	(a) Resin (g)	(b-1) Photo-acid generator (g)	(b-2) Photo-acid generator (g)	(c) Surface active agent (g)
Additional Example 2	Resin P-1 (1.0) <i>PNE Resin</i>	Photo-acid generator B2-5 (0.04) ***	Photo-acid generator B1-2 (0.007) **** <i>Kobayashi</i>	Surface active agent β -1 (0.004) ***** <i>Kobayashi</i>
Additional Comparative Example 2	Resin A-1 (1.0) ** <i>Kobayashi Resin</i>	Photo-acid generator B2-5 (0.04) ***	Photo-acid generator B1-2 (0.007) ****	Surface active agent β -1 (0.004) *****

*: Resin P-1 of Example 1 described in the present specification

**: Resin A-1 of Example 2 described in Kobayashi, which falls outside the scope of the invention

***: Photo-acid generator B2-5 of Example 2 described in Kobayashi, which falls within the scope of the invention

****: Photo-acid generator B1-2 of Example 2 described in Kobayashi, which falls within the scope of the invention

*****: Surface active agent β -1 of Example 2 described in Kobayashi

The components set forth in Table B1 above were dissolved in 5.5 g of PGMEA as a solvent, and then filtered through a filter having a pore diameter of 0.2 μ m to prepare a resist solution. The resist solution thus prepared was applied to a silicon wafer by means of a spin coater, and then dried over a vacuum adsorption type hot plate at a temperature of 80°C for 60 seconds to obtain a resist film having a thickness of 0.7 μ m.

The resist film was then exposed using a KrF excimer laser stepper (NA = 0.63) of a wavelength of 248 nm. After exposure, the resist film was heated over a 100°C hot plate for 90 seconds, immediately dipped in a 0.26N aqueous solution of tetramethylammonium hydroxide (TMAH) for 60 seconds, rinsed with water for 30 seconds, and then dried. The pattern on the silicon wafer thus formed was

but in Kobayashi
 β -1 is
 for acid
 diffusion
 controller
 (tri-n
 hexylamine)
 0.0025

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observed under a CD-measurement scanning type electron microscope (CD-SEM).

As a result, the resist performance (pitch dependency and exposure latitude) set forth in Table B2 below was obtained.

The evaluation of pitch dependency and exposure latitude was carried out according to the methods described in the present specification.

Table B2

	Iso/Dense difference ACD	Exposure latitude Δ_{exp}
Additional Example 2	13.8 nm	11.8%
Additional Comparative Example 2	25.1 nm	8.5%

Additional Example 3 and Additional Comparative Example 3.

Additional Comparative Example 3 was made according to US 6,004,721

(Tan).

Table C1

	(a) Resin (g)	(b-1) Photo-acid generator (g)	(b-2) Photo-acid generator (g)	(c) Surface active agent (ppm)
Additional Example 3	Resin B-1 (1.60) *	Photo-acid generator D-1 (0.080) **	Photo-acid generator (II-1) (0.080) ***	Surface active agent W-1 (100) ****
Additional comparative Example 3	Resin B-1 (1.60) *	Photo-acid generator D-1 (0.080) **	None	Surface active agent W-1 (100) ****

*: Resin B-1 of Example 1 described in Tan, which falls within the scope of the invention

**: Photo-acid generator D-1 of Example 1 described in Tan, which falls within the scope of the invention

***: Photo-acid generator (II-1) of Example 7 described in the present specification

****: Surface active agent W-1 of Example 7 described in the present specification

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The components set forth in Table C1 above was dissolved in 8 g of PGMEA as a solvent, and then filtered through a filter having a pore diameter of 0.2 μm to prepare a resist solution. The resist solution thus prepared was applied to a silicon wafer by means of a spin coater, and then dried over a vacuum adsorption type hot plate at a temperature of 130°C for 60 seconds to obtain a resist film having a thickness of 0.8 μm .

The resist film was then exposed using a KrF excimer laser stepper (NA = 0.63) of a wavelength of 248 nm. After exposure, the resist film was heated over a 100°C hot plate for 60 seconds, immediately dipped in a 0.26N aqueous solution of tetramethylammonium hydroxide (TMAH) for 60 seconds, rinsed with water for 30 seconds, and then dried. The pattern on the silicon wafer thus formed was observed under a CD-measurement scanning type electron microscope (CD-SEM).

As a result, the resist performance (pitch dependency and exposure latitude) set forth in Table C2 below was obtained.

The evaluation of pitch dependency and exposure latitude was carried out according to the methods described in the present application.

Table C2

	Iso/Dense difference ΔCD	Exposure latitude Δexp
Additional Example 3	13.7 nm	11.5%
Additional Comparative Example 3

In Additional Comparative Example 3, measurements were not obtained, since the limiting resolution was 0.20 μm (the minimum dimensional value resolved was 0.20 μm) and the image was not resolved to 0.17 μm and 0.15 μm , which are dimensions to be evaluated for pitch dependency and exposure latitude.

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respectively,

The comparison of Additional Example 1 with Additional Comparative Example 1 shows that Additional Comparative Example 1 containing the resin (a) for use in the invention, and the photo-acid generator (b-1) for use in the invention, but free of the photo-acid generator (b-2) for use in the invention, was not sufficient in resolution to be evaluated in the invention. Thus, it is understood that the effect of the invention is exerted by the incorporation of the resin (a) having a specific structure and the specific photo-acid generators (b-1) and (b-2).

Further, the comparison of Additional Example 2 with Additional Comparative Example 2 shows that Additional Comparative Example 2 containing the photo-acid generators (b-1) and (b-2) for use in the invention and a resin having a structure different from that of Additional Example 2, could not exert a sufficient effect in pitch dependency and exposure latitude. Thus, it is understood that the effect of the invention is exerted by the incorporation of the resin (a) having a specific structure and the specific photo-acid generators (b-1) and (b-2).

Moreover, the comparison of Additional Example 3 with Additional Comparative Example 3 shows that Additional Comparative Example 3 containing the resin (a) for use in the invention, and the photo-acid generator (b-1) for use in the invention, but free of the photo-acid generator (b-2) for use in the invention could not provide a sufficient resolution to be evaluated in the invention. Thus, it is understood that the effect of the invention is exerted by the incorporation of the resin (a) having a specific structure and the specific photo-acid generators (b-1) and (b-2).

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As mentioned above, the invention can exert a specific effect by incorporating the resin (a) having a specific structure and the specific photo-acid generators (b-1) and (b-2), and thus is not obvious from Iwasa and Tan, each of which don't disclose the photo-acid generator (b-2) for use in the invention, and Kobayashi which doesn't disclose the resin (a) of the invention.

I declare further that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under §1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or any patent issuing thereon.

Respectively submitted,

Date: June 25, 2002

Shivichi Kanna

Shinichi Kanna